VERMONT'S ENDANGERED PLANTS AND THE THREATS TO THEIR SURVIVAL

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The major threat to endangered plant species in the Northeast comes not from collection or commercial exploitation but from ever increasing recreation and development pressures. In much of New England today, it is the habitats of these species that are threatened; certainly this is true in Vermont. While it is also true that there are occasional threats to plants by botanists and gardeners who collect specimens for scientific or horticultural purposes, the real concern is with builders and hikers.

For a small non-coastal state, Vermont has a remarkable diversity of habitat types. The many combinations of elevations, slope, aspect, moisture, and soil types support over 1900 species of vascular plants, of which approximately 1400 are indigenous.

The Vermont flora has been studied from the earliest days — since before the state was a state, or even before it was a republic. Samuel de Champlain, who in 1609 reported the chestnut, *Castanea dentata* (Marsh.) Borkh. from the shores of the lake that now bears his name, was one of the first westerners to comment on plants in what is now the State of Vermont (Grant, 1907).

Champlain was followed by the botanist, Luigi Castiglioni, an Italian nobleman, whose concerns, when he visited Vermont in 1785, were more with rattlesnakes than plants (Castiglioni, 1790). Pehr Kalm, André Micheaux and his son François André, Frederick Pursh, and Samuel Rafinesque followed in swift succession. A list of the early visitors to Vermont reads something like a botanical "Who's Who", yet none of these pioneer explorers made any very startling botanical discoveries.

When Kalm visited Vermont in 1749 the weather was very dry and he had little success in plant collecting (Eggleston, 1907). One interesting plant which Kalm did find was *Shepherdia canadensis* (L.) Nutt. He remarked it was flourishing ". . . everywhere on the shore of Lake Champlain." (Kalm, 1753–1761). Today *Shepherdia* is a rare plant in Vermont.

The elder Micheaux spent several days in Vermont in 1792 and listed some 175 species found about Lake Champlain (Eggleston, 1910). Little is known of the botanical discoveries of Francois

Andre Micheaux who visited Vermont in 1806 or of Rafinesque's trip through the State in 1816.

The weather was cold and rainy when Pursh visited Vermont in 1807. He holed up in Rutland where he waited, seemingly in vain, for a letter from his sponsor with funds to continue his journey. He became ill with ". . . a fever & bloody flux." Finally, in desperation, seeing ". . . no other means of getting away from here, than to contrive some way to get money to go on with, & pay my reckoning here, I, with great reluctance, sold my fowling piece this day; God knows whether the money will be enough to bring me on but I must rough it through as well as I can." As fate would have it, the long awaited letter and funds came the following day (Pursh, 1869). In all, Pursh spent approximately three weeks in Vermont during which time he collected some 30 or 40 specimens, mostly weeds and other common species (McVaugh, 1936). His most notable find was *Polystichum Braunii* (Spenner) Fee, the first record of the species in the New World.

It remained for more recent botanists, such as James Watson Robbins, Alphonso Wood, C. C. Frost, and Cyrus Pringle, to make the unusual botanical discoveries in Vermont.

Under circumstances somewhat less rigorous than those encountered by Pursh, James Watson Robbins, M.D., of Uxbridge, Massachusetts, visited Vermont in 1829. Robbins was the first botanist to find many of Vermont's rarest and most interesting plants. *Cornus florida* L., *Floerkea proserpinacoides* Willd., and *Valeriana uliginosa* (Torr. & Gray) Rydb. are a few of the species found by Robbins. Robbins had an eye, a very sharp eye, for discovering the unusual. He was, for example, the first botanist in North America to recognize *Wolffia,* our smallest phanerogam (Gray, 1879). On a limestone ledge only 200 feet long by 50 feet wide along the Winooski River near Burlington, Robbins discovered Vermont's most famous and noteworthy plant, *Astragalus Robbinsii.* The species was named for Robbins by his friend and admirer William Oakes. By 1894 *Astragalus Robbinsii* was extinct (Rydberg, 1924). The circumstances surrounding its demise can at best be called regrettable. The cause of its extinction appears to have been a simple case of over-collection and development. No one, it seems, made any attempt to save the species.

Cyrus G. Pringle, a well known Vermont botanist, made his living as a professional plant collector. He collected plants for Asa Gray,

the American Museum of Natural History, and the Smithsonian Institution (Davis, 1936). In addition, he offered plants for sale to private collectors, usually at ten cents per specimen. Asa Gray once called Pringle the "prince of collectors" (Brainerd, 1911). Indeed, Pringle was an assiduous collector with an eye for the unusual. *Astragalus Robbinsii* appears on the trade lists that Pringle circulated to his customers. One can assume it was a "best seller," for the species was never found except at its type station, the tiny river ledge where Robbins first discovered it. That ledge, incidentally, was sufficiently well known to nineteenth century botanists to merit its own special name, "Phaca Ledge" (*Phaca* = *Astragalus*). The name, Phaca Ledge, appears on labels of many early collections of *Astragalus Robbinsii.*

Pringle, when reminiscing about his botanical career, said, there is ". . . a rumor current among botanists that Dr. Robbins' station for *Astragalus Robbinsii* . . . has been obliterated" but, he went on to say, ". . . the rumor proved unfounded." Furthermore, he remarked, there ". . . had been gathered a supply of these plants sufficient for all the herbaria of the world." (Pringle, 1897). And indeed there had — and all from the tiny Phaca Ledge! The ". . . herbaria of the world" abound in Pringle's collections of *Astragalus Robbinsii.* Pringle, however, does not warrant the blame for the extinction of *Astragalus Robbinsii* for he was not, in fact, the last person to see it alive. That distinction, it appears, belongs to W. W. Eggleston and L. R. Jones. Eggleston and Jones, on June 15, 1893 collected several specimens of *Astragalus Robbinsii* and noted on their labels, "last collection ever made." Interestingly, four days later Jones returned to Phaca Ledge and collected at least one more specimen. The reason Eggleston and Jones were inspired to collect these specimens was that a dam was about to be built and the ledge on which *Astragalus* grew was just upstream from the construction site. When the dam was completed, Phaca Ledge was inundated and has been under water ever since. There remains a serious question as to whether or not the extinction of the species was due principally to the dam. The large number of existing herbarium specimens of a species known only from so limited a habitat suggests that its fate may already have been sealed, dam or no dam.

The Endangered Species Act of 1973, P.L. 93–205 (87 Stat. 884), defines an endangered species as ". . . any species which is in danger of extinction throughout all or a significant portion of its range . . ."

If that definition is applied to the flora of Vermont only a few species would meet that criterion. Nonetheless, many species in the State are threatened by habitat destruction and, unless the trend is reversed, the number warranting "endangered" status will increase rapidly. There are many attractive and showy species in Vermont which are in need of protection to avoid commercial exploitation by wildflower nurserymen, but presently fall far short of being considered truly endangered. The white trillium, *Trillium grandiflorum* (Michx.) Salisb., and the moccasin flower, *Cypripedium acaule* Ait., for example, are sufficiently abundant in Vermont to render untenable their inclusion on the state list of endangered species. Another species, the Mayflower, *Epigaea repens* L., has long been the cause of much concern to New England wildflower lovers. It appears on many state lists of protected plants. Yet in Vermont this species is abundant, even along interstate highways on recently disturbed soil.

There are, in contrast, some Vermont species which are truly endangered. These include: *Hydrastis canadensis* L., the goldenseal, a species now known from but a single station in Vermont and a plant that is threatened by housing development; *Cypripedium arietinum* Ait., the ram'shead lady's-slipper, a species formerly found throughout the state but now exceedingly rare and threatened by road-widening and housing development; and *Scirpus ancistrochaetus* Schuyler, a species proposed by the Smithsonian Institution as a candidate for Federal listing as an endangered species, known in Vermont from but a single location, the type station, which is at the edge of a frequently mowed hayfield.

The Virginia chain fern, *Woodwardia virginica* (L.) Sm., is a rare fern in Vermont. It is known in the State from only three or four stations and has not been seen at most of these for many years. Its demise at one station is noteworthy. In the Town of Colchester, the chain fern was once well known along the border of a small pond; so well known, in fact, that botanists dubbed the pond "Woodwardia Pond." This station was destroyed when it was bulldozed under during preparation of the area for a missile launching site. The ground-to-air defense missile, "the Bomark," became obsolete before construction of the launching site was completed, but not before the *Woodwaria* station was destroyed.

While Woodwardia's plight in Vermont is a sad story, it is perhaps appropriate to relate, in a lighter vein, how Vermont lost one population of another rare species.

Astragulus Jesupi (Egglest. & Sheld.) Britt. is known from the banks of the Connecticut River at Hartland, Vermont and along the opposite shore in New Hampshire. It is also known from Hart Island which lies between the two areas noted above. Labels of specimens collected from the island read "Hart's Island, Hartland, Vt." The island population of *Astragulus Jesupi* was lost to the State of Vermont when the United States Supreme Court decreed, in its decision *re* Vermont *v.* New Hampshire 289 U. S. 593 (1933), that the boundary between the states was the low water mark along the west bank of the Connecticut River. Vermont's loss, of course, was New Hampshire's gain!

A recent study of Vermont's rare and endangered flora indicates that a high percentage of these species occur only on alpine or subalpine areas (Countryman, 1978). Today Vermont's higher elevations are a good deal less remote than they were a few decades ago. Roads, ski-lifts, radio and television antennas, and an ever increasing number of hikers pose a real and growing threat to alpine and subalpine plants and to the soils which support them. Although Vermont lies roughly between the same latitudes and is approximately the same size as New Hampshire, there is a great difference between the areas of high elevations possessed by the two states. Vermont has only five peaks over 4000 feet. The highest, Mt. Mansfield, is only 4393 feet above sea level. In contrast, New Hampshire has 47 peaks over 4000 feet (AMC, 1979). Of Vermont's 9600 square miles, less than one square mile is above timberline. Only four small areas in Vermont host significant populations of alpine plants: Mt. Mansfield, Smuggler's Notch, Camel's Hump, and the Willoughby area.

While Mt. Mansfield may be dwarfed by peaks in neighboring states, it is high enough to have accumulated several transmitter antennas. Many types of antennas — FM, AM, police, weather, etc.——have been placed on Mt. Mansfield. Even the Bomark missile system mentioned previously was to have included an extensive guidance system installation on Mt. Mansfield. These electronic devices must be maintained in both winter and summer. Ski trails, ski lifts, and other facilities for skiers take up considerable space on Mt. Mansfield. In addition, the mountain has a toll road, a parking lot, and many hiking trails. As a result, much alpine habitat has been destroyed by construction and erosion. *Diapensia lapponica* L. is threatened by hikers in the two small areas where it grows on Mt.

Mansfield. Between Memorial Day and Columbus Day an estimated 40,000 hikers visit Mt. Mansfield (Peet, 1979). Some of the other threatened species which have been found in Vermont only on Mt. Mansfield are *Hierochloë alpine* (Sw.) R. & S., *Salix Uva-ursi* Pursh, *Arenaria rubella* (Wahlenb.) Sw., and *Geocaulon lividum* (Richards.) Fern.

Camel's Hump, a high peak south of Mt. Mansfield, and with a similar flora, has only about ten acres above treeline, yet it hosts some 10,000 hikers a year (Peet, 1979). Obviously such large numbers of hikers cause excessive erosion along trails and trample many rare plants. Both Mt. Mansfield and Camel's Hump are now patrolled during the hiking season by teams of "ranger-naturalists" who attempt to keep hikers on the trails and away from sensitive areas, thus providing some protection to the alpine flora.

Smuggler's Notch is the divide separating Mt. Mansfield from Sterling Mountain to the east. It includes cliffs and ledges on both sides where many interesting plants have been observed. Some of the plants found on Mt. Mansfield and Smuggler's Notch are among Vermont's rarest species. *Deschampsia atropurpurea* (Wahlenb). Scheele, collected by Joseph Torrey on Mt. Mansfield in 1853, has never been seen in the State again (Eggleston, 1895). *Polygonum viviparum* L. and *Geocaulon lividum* (Richards.) Fern. appear not to have been seen in Vermont in this century although many specimens were collected from Mt. Mansfield prior to 1900. In 1878, Thomas Morong found in Smuggler's Notch a single plant of *Primula mistassinica* Michx. in flower, which he collected. The species has never been found there again. *Arnica mollis* Hook. was collected on Mt. Mansfield in 1911 by Charles Schweinfurth and Harold St. John; it has never been found again in the State. Some of the other rarities that occur on Mt. Mansfield and Smuggler's Notch are: *Lycopodium Selago* L., *Woodsia alpina* (Bolton) S. F. Gray, *Dryopteris fragrans* (L.) Schott, *Calamagrostis inexpansa* Gray var. *novae-angliae* Stebbins, *Castelleja septentrionalis* Lindl., *Hedysarum alpinum* L., *Saxifraga aizoides* L., S. *Aizoön* Jacq., and *S. oppositifolia* L.

Lake Willoughby and its associated mountains, Mt. Pisgah and Mt. Hor, comprise a strikingly scenic and botanically unique area in the northeastern part of Vermont. Calcareous cliffs and ledges there rise to elevations of only 2600 feet, far below timberline, yet they support a local population of far northern plant species. Robbins

had been in sight of the Willoughby cliffs in 1829, as had John Carey in 1835 or 1836, yet neither explored the area. It remained for Alphonso Wood to discover what the natives called the "Garden of Edom" on his trip to Mt. Pisgah in the summer of 1845. Wood climbed from lake level to the top of the mountain and found *Hedysarum alpinum* L. and *Saxifraga aizoides* L., neither of which had previously been reported as occurring in the United States (Wood, 1847). He also found *Primula mistassinica* Michx., a species then unknown in the United States, save for a single station at Seneca, New York. Five years later, in 1852, C. C. Frost, the "Shoemaker Botanist" from Brattleboro, Vermont, visited Willoughby in company with the Reverend A. H. Clapp. They found *Astragalus Blakei* Egglest. and *Braya humilis* (C. A. Mey.) Robbins (Russell, 1852). The latter species is still known elsewhere in the United States only in northern Michigan. In 1854 William Boott visited the Willoughby area and discovered *Saxifraga Aizoön* Jacq. Boott was followed by Horace Mann, Jr., the Faxon brothers, and Cyrus Pringle. *Woodsia alpina* (Bolton) S. F. Gray and *Asplenium viride* Huds. were added to the list (Eggleston, 1922). Walter Deane and Judge Churchill, both founding members of the New England Botanical Club, spent two weeks botanizing at Willoughby in 1885. Deane prepared a report of their trip for the Botanical Gazette in which he states they traveled via the "Boston and Maine Airline" (Deane, 1886). Judging from the year, 1885, and the travel time from Boston, eight hours, it may be concluded that they traveled by train, not by airplane.

Most of Vermont's alpine and subalpine species have been found at the four classical locations noted above, where the majority were discovered before the turn of the century. There are, however, some other sites for alpine species in Vermont and some more recent discoveries. In 1908, for example, G. Lewis Dutton found *Sedum Rosea* (L.) Scop. on Mt. Horrid in Rochester, Vermont, one of the few inland stations in the country for this species (Dutton, 1908). In 1959, Philip Cook discovered the only known station in the United States for *Arenaria marcescens* Fern. at Haystack Mountain in Lowell, Vermont (Cook, 1959).

What is certainly one of the more exciting and surprising botanical finds in New England in this century was made by Donald White in 1970. White found *Potentilla Robbinsiana* Oakes on a Vermont mountain top. This diminutive species was formerly known only from a limited area on Mt. Washington, New Hampshire (Storks &

Crow, 1978). White's discovery was no accident. Like Robbins, White had sharp and well-trained eyes and a great deal of practice in plant collecting. He was elected to membership in the New England Botanical Club in 1911 and has been collecting plants ever since. His discovery, at age 77, of *Potentilla Robbinsiana* seems a fitting climax to a long career as an enthusiastic and ardent plant collector and should serve as an inspiration to younger botanists.

A cynic might say that the intellectually attractive thing about lists of rare plants is that, in the modern World, they are subject to so much revision. These lists have a purpose beyond the challenge of keeping them current. Their purpose, ultimately, is as an indicator of habitats important to our understanding and appreciation of nature. The responsible botanist knows this and, even in the face of official indifference, will do his part in protecting important species. Vermont's program of ranger-naturalists, whose job it is to inform and, indeed, discipline the considerable crowds that now visit our higher peaks, has worked well. It has been accepted and welcomed by most hikers. As we perceive new needs for protection, the botanist should be willing to accept an active, visible role even beyond the also necessary job of scientific advisor.

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